MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Mail Stop 2321
Gaithersburg, Maryland 20899-2321

SRM Number: 2628a
MSDS Number: 2628a
SRM Name: Nitric Oxide in Nitrogen
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Nitric Oxide in Nitrogen

Description: This SRM mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psi) which provides the user with 0.73 m^3 (25.8 ft^3) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-660 stainless steel valve, which is the recommended outlet for this nitric oxide mixture. NIST recommends that this cylinder not be used below 0.7 MPa (100 psi).

Other Designations: Nitric Oxide (nitrogen monoxide) in **Nitrogen** (dinitrogen) **Gas Cylinder**

Chemical Name	Chemical Formula	CAS Registry Number
Nitric Oxide	NO	10102-43-9
Nitrogen	N_2	7727-37-9

DOT Classification: Nonflammable Gas, UN1956

Manufacturer/Supplier: Available from a number of suppliers

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Oxide	10 µmol/mol	ACGIH TWA: 25 mg/kg or 30 mg/m^3
		OSHA TWA: 25 mg/kg or 30 mg/m^3
Nitrogen	balance	simple asphyxiant
		Rat, Inhalation: LC_{50}: 1068 mg/m^3/4 h
		Mouse, Inhalation: LC_{LO}: 320 mg/kg

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Oxide	Nitrogen
Appearance and Odor: colorless with pungent odor; changes color on exposure to light	**Appearance and Odor:** colorless and odorless
Relative Molecular Mass: 30.01	**Relative Molecular Mass:** 28.0134
Density: 1.3402 g/L	**Density:** 1.2506 g/L
Vapor Density (air = 1): 1.036	**Vapor Density (air = 1):** 0.967
Vapor Pressure (-151.7 °C): 760 mm Hg	**Vapor Pressure (-196 °C):** 760 mm Hg
Freezing Point: -164 °C to -161 °C	**Freezing Point:** -210 °C
Boiling Point: not available	**Boiling Point:** -196 °C
Viscosity (@ 25 °C): 0.0188 cP	**Viscosity (@ 27 °C):** 0.01787 cP
Water Solubility: 4.6 %	**Water Solubility:** 1.6 %
Solvent Solubility: soluble in sulfuric acid, alcohol, ferrous sulfate solutions, and carbon disulfide	**Solvent Solubility:** soluble in liquid ammonia; slightly soluble in alcohol

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this nitric oxide/nitrogen mixture **DO NOT** exist. The actual behavior of the mixture may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: Nonflammable

Autoignition Temperature: Not Applicable

Flammability Limits in Air (Volume %): **UPPER:** Not Applicable
LOWER: Not Applicable

Unusual Fire and Explosion Hazards: Cylinders may rupture under fire conditions. Nitrogen reacts with lithium, magnesium, neodymium at high temperatures. Mixtures of ozone and nitrogen may be explosive. Titanium is the only element that will burn in nitrogen.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Fire fighters should wear full protective clothing and self-contained breathing apparatus (SCBA) when this material is involved in a fire. Keep fire cylinders cool with water spray. If possible, stop the product flow.

SECTION V. REACTIVITY DATA

Stability: **X** **Stable** ____ **Unstable**

Conditions to Avoid: Protect cylinders from physical damage and sources of heat. **DO NOT** store in poorly ventilated areas.

Incompatibility (Materials to Avoid): Nitric oxide is incompatible with metals, bases, metal oxides, reducing agents, combustible materials, halocarbons, oxidizing materials, halogens, metal carbides, and metal salts. Nitrogen reacts with metals and oxidizing materials.

See Section IV: *Fire and Explosion Hazard Data*

Hazardous Decomposition or Byproducts: Thermal decomposition of both nitric oxide and nitrogen will produce oxides of nitrogen.

Hazardous Polymerization: ____ **Will Occur** **X** **Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: **X** **Inhalation** **X** **Skin** ____ **Ingestion**

Nitrogen: This material is a high pressure gas that can cause rapid suffocation. This gas may also cause eye, skin, and respiratory tract burns. The mixture can act as a simple asphyxiant by displacing air necessary for life. Nitrogen inhaled under increased atmospheric pressure, (>1.5 atmospheres), may dissolve in the fat-containing brain cells, and act as an anesthetic, causing necrosis. Persons who have been exposed to nitrogen under increased pressure and then suddenly released from the pressure may develop decompression sickness. Decompression illness is caused by the formation of nitrogen bubbles in the blood following a rapid drop in pressure and is characterized by severe pains in the joints and chest, skin irritation, cramps, and paralysis.

Nitric Oxide: Nitric oxide forms acids in the lungs, which are irritants that cause congestion of the throat and bronchi and edema of the lungs. Symptoms include headache, lowering of blood pressure, dizziness, development of cyanosis, and loss of consciousness. Because of its minor irritating affects on the upper respiratory tract, the warning properties are limited. Long term exposure to nitric oxide may cause permanent decrements in pulmonary function.

Medical Conditions Generally Aggravated by Exposure: Respiratory disorders are aggravated by nitric oxide.

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs		X
By the Occupational Safety and Health Administration (OSHA)		X

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with copious amounts of water for at least 15 minutes while removing contaminated clothing. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance if necessary.

Inhalation: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Lay victim with head and chest lower than hips to improve drainage of fluids from the lungs. Obtain medical assistance.

Ingestion: Not Applicable

TARGET ORGAN(S) OF ATTACK: Nitric Oxide: blood

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released: Evacuate and ventilate area. Remove leaking cylinder to exhaust hood or safe outdoor area. Shut off source if possible and remove source of heat. In case of leakage, use SCBA. Leaks of nitric oxide are detectable by the formation of reddish-brown nitrogen dioxide.

Waste Disposal: Dispose of gas into an adequate amount of alkaline potassium permanganate solution. Dispose of non-refillable cylinders in accordance with federal, state, and local regulations. **DO NOT** return the empty cylinder to the supplier.

Handling and Storage: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders. Wear safety shoes when handling cylinders. Use adequate general and local exhaust ventilation to maintain concentrations below exposure limits and to avoid asphyxiation. A chemical safety shower and an eyewash station must be readily available. For protection of eyes, wear safety glasses.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store in well ventilated areas away from combustibles. Keep valve protection cap on cylinders when not in use.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Source: MDL Information Systems, Inc., MSDS *Nitric Oxide,* 11 December 2001.
MDL Information Systems, Inc., MSDS *Nitrogen,* 11 December 2001.

Disclaimer: Physical and chemical data contained in this MSDS are provided for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references, however NIST does not certify the data on the MSDS. The certified values for this material are given only on the NIST Certificate of Analysis.